

A review of the spider genus *Hygropoda* in Thailand (Araneae, Pisauridae)

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A review of the spider genus *Hygropoda* in Thailand (Araneae, Pisauridae). - Three species belonging to the spider genus *Hygropoda* Thorell are recorded from Thailand. All of them have previously been reported from Yunnan Province, southern China. The males of *H. argentata* Zhang, Zhu & Song, 2004 and *Hygropoda yunnan* Zhang, Zhu & Song, 2004 are described and illustrated here for the first time from specimens collected in northern Thailand. The female of *H. campanulata* Zhang, Zhu & Song, 2004 is redescribed and illustrated from a specimen collected in western Thailand.

Keywords: Taxonomy - conspecific sex - zoogeography - new record - *H. argentata* - *H. campanulata* - *H. yunnan*.

INTRODUCTION

Most documented information on the spider family Pisauridae occurring in Thailand comes from lists of taxa obtained in the course of faunistic surveys. Okuma (1968) first recorded two *Dolomedes* species collected from paddy fields in northern and northeastern Thailand. In the result of her next expedition to several other localities, she recorded the genus *Hygropoda* for the first time from Thailand (Okuma & Wongsiri, 1973), although the specimens were identified only to generic level. Unfortunately, we were unable to locate the specimens examined by Okuma. Dankittipakul (2002) reported *Hygropoda argentata* Zhang, Zhu & Song, 2004 to occur in relatively high abundance along a river running through dry deciduous dipterocarp forests in the Doi Inthanon National Park of northern Thailand. When examining a spider collection deposited at Chiang Mai University, the so far unknown males of two *Hygropoda* species described from southern China were identified. These are treated here. Earlier records of pisaurid spiders from Thailand refer only to a male of *Perenethis venusta* L. Koch collected in central Thailand and to males of *Polyboea vulpina* Thorell collected in the Khao Yai National Park and in the Chantaburi Province, eastern Thailand (Sierwald, 1997). The unusually low number of species

previously recorded from the country suggests that its pisaurid fauna is still superficially known and that further basic taxonomic and faunistic work is required.

To date, the following representatives of the genus *Hygropoda* are known from Thailand: *H. argentata* Zhang, Zhu & Song, 2004, *Hygropoda yunnan* Zhang, Zhu & Song, 2004 and *H. campanulata* Zhang, Zhu & Song, 2004. All of them were previously reported from Yunnan Province in southern China. Their taxonomic treatment is presented below.

MATERIAL AND METHODS

External morphology was examined, measured and drawn with an Olympus SZX-9 stereomicroscope equipped with a drawing tube. Measurements of leg segments were taken from the dorsal side. All measurements are in millimeters. Vulvae were drawn in cleared state after immersion in 90% lactic acid for 10-30 minutes.

The material examined will be deposited in the collections of the Muséum d'histoire naturelle de la Ville de Genève, Switzerland (MHNG, curator: P. J. Schwendinger) and in the Thailand Natural History Museum, National Science Museum, Pathumthani Province, Thailand (TNHM, curator: J. Nabhitabhata).

Abbreviations used in the text and in the figures are as follows: AER, anterior eye row; ALE, anterior lateral eyes; AME, anterior median eyes; BE, basal projection of embolus; C, conductor; Cy, cymbium; DTA, distal tegular apophysis; E, embolus; FD, fertilization duct; ID, insemination duct; juv., juvenile; LL, lateral lobe of epigyne; MA, median apophysis; MOQ, median ocular quadrangle; PER, posterior eye row; PLE, posterior lateral eyes; PME, posterior median eyes; RTA, retrolateral tibial apophysis; S, spermathecae; T, tegulum.

In the text 'Fig.' and "Figs" refer to figures herein, while 'fig.' and "figs" refer to figures published elsewhere.

TAXONOMY

Family **PISURIDAE** Simon, 1890

Genus *Hygropoda* Thorell, 1894

Hygropoda Thorell, 1894: 4; Simon, 1898: 315; Pocock, 1900: 245; Hu, 1984: 260; Yaginuma, 1986: 176.

TYPE SPECIES: *Tegenaria dolomedes* Doleschall, 1859 by original designation.

DIAGNOSIS: Representatives of the genus *Hygropoda* can be recognized by morphological and genitalic structures which are considered synapomorphic: Tarsi of legs long and slender (except for leg III), highly flexible (Fig. 1); anterior eye row slightly procurved, posterior one strongly recurved (Figs 2-4); conductor and distal tegular apophysis of the male palp membranous (Figs 5, 12) (conductor sclerotized in *Eurychoera* Thorell). Further SEM examination by Zhang *et al.* (2004) revealed an additional diagnostic character: Posterior lateral and posterior median spinnerets provided with cylindrical gland spigots (*sensu* Zhang *et al.*, 2004: 381, figs 209, 211-213). However, cylindrical gland spigots produce egg sac silk, and as nearly all spider

species construct egg sacs, nearly all female spiders will possess cylindrical spigots. Accordingly, this character cannot be considered an apomorphy for the genus *Hygropoda* (P. Sierwald, pers. comm.).

DESCRIPTION: Prosoma generally flattened, in profile slightly higher in cephalic part (Figs 1, 2). Carapace yellowish, with two dark parallel bands and a pair of dark marginal bands; often with a thin narrow line of dark brown colour between PME and fovea. Fovea longitudinal, deep (Figs 2-4). Chelicerae with three teeth each on pro-margin and retromargin of fang groove. Clypeus not as high as the ocular quadrangle. AER slightly procurved or straight, shorter than PER; PER strongly recurved; PME largest. Legs more or less distinctly annulated, long and slender, provided with erect spines; tarsi of legs I, II and IV distinctly elongate, highly flexible. Opisthosoma elongate oval, covered with fine pubescence; dorsum yellowish posteriorly, dark median band anteriorly bifurcated, followed by a series of transverse lines. Male palp (Figs 5-7, 12-14) with palpal tibia curved dorsad; retrolateral tibial apophysis broad at base, tapering distally, pointing ventrally; cymbium digitiform, usually elongate; bulb more or less rounded; distal tegular apophysis petal-shaped, membranous; median apophysis strongly sclerotized, often with denticle; conductor membranous, situated retrolaterally; embolus needle-shaped, originating prolaterally; basal extension of embolus forming a sclerotized plate, accommodating the embolus. Epigyne (Figs 8, 10, 15) often with median field; lateral lobes well-developed in some species; vulva simple (Figs 9, 11, 16), with more or less straight insemination ducts descending to strongly sclerotized, posteriorly located spermathecae.

NATURAL HISTORY: Almost all *Hygropoda* species are riparian spiders that can be found close to the edge of running streams and rivers. They build sheet webs on the upper side of large leaves (Cerveira & Jackson, 2002). A male specimen collected by sweeping vegetation overhanging a river in northern Thailand showed its first tarsus winding around a small dried stick. This suggests that the flexible tarsi of *Hygropoda* have an anchoring function (personal observations).

DISTRIBUTION: The fishing spider genus *Hygropoda* currently comprises 21 valid species distributed throughout the tropics, ranging from South America, Africa to Australia, with a small radiation into China and Japan (Barrios & Litsinger, 1995; Davies, 1985; Kishida, 1936; Platnick, 2008; Pocock, 1897; Reimoser, 1934; Strand, 1907; Thorell, 1877, 1895; Yaginuma, 1986; Zhang *et al.*, 2004). It is highly unlikely that the South American species assigned to *Hygropoda* are congeneric. According to all we know at this time, the family Pisauridae does not occur in South America. Thus, South American species assigned to *Hygropoda* most likely belong to the family Trechaleidae (P. Sierwald, pers. comm.).

Hygropoda argentata Zhang, Zhu & Song, 2004

Figs 1, 2, 4-9

Hygropoda argentata Zhang, Zhu & Song, 2004: 381, figs 71-73 (description of ♀).

MATERIAL EXAMINED: Northern Thailand, Chiang Mai Province, Chomthong District, Doi Inthanon National Park, near kilometer marker 20, 510 m: 2♂ [MHNG-HA1, TNHM], 2♀ [MHNG-HA2, TNHM], 24.vi.2000. – 1 juv. [TNHM], 27.xi.1999; 1 juv. [TNHM], 25.ix.1999; 3 juv. [TNHM], 29.i.2000. – 4 juv. [TNHM], 23.x.1999. – 2 juv. [TNHM], 29.iv.1999, all leg. P.

Dankittipakul; Doi Inthanon National Park, near Siritharn Waterfall, 980 m, 1 ♂, 1 ♀ [TNHM], 9.v.2007, leg. N. Likhitrakarn & A. Lewvanich; Doi Inthanon National Park, Pha Mon, 1010 m, 1 ♀ [TNHM], 24.vi.2000, leg. P. Dankittipakul.

EXTENDED DIAGNOSIS: Males of *Hygropoda argentata* resemble those of *H. higenaga* (Kishida, 1936) in having a palp with similar shape of distal tegular apophysis, conductor and embolus, but can be distinguished by the sickle-shaped median apophysis lacking a mesal process. The median apophysis of *H. higenaga* is apically hooked and provided with a mesal process (Zhang *et al.*, 2004: fig. 72). Females of *H. argentata* can be recognized by their epigyne with an anterior hood, with short insemination ducts, and by spermathecae being divided into two parts: Anterior spermathecal head and posterior spermathecal base.

DESCRIPTION: Male (MHNG-HA1). Total length 7.26. Carapace 2.95 long, 2.31 wide. Opisthosoma 4.31 long, 1.72 wide.

Carapace slightly wider than long (Fig. 4); higher behind than in front, gradually lowering towards cephalic area. Fovea a deep longitudinal furrow located posteriorly. Carapace yellow, with two dark parallel bands running from behind PME and PLE to posterior margin; a thin mesal line running between PME and fovea; dusky stripes on both lateral margins. AER slightly recurved; PER strongly recurved, much wider than AER; MOQ longer than wide, wider behind than in front. Eye sizes and interdistances: AME 0.22, ALE 0.18, PME 0.25, PLE 0.27; AME-AME 0.15, AME-ALE 0.10, PME-PME 0.34, PME-PLE 0.48; MOQ 0.64 long, front width 0.60, back width 0.92. Chelicerae orange-brown, fangs reddish brown; three small promarginal and three larger retromarginal teeth on cheliceral fang grooves. Sternum yellow.

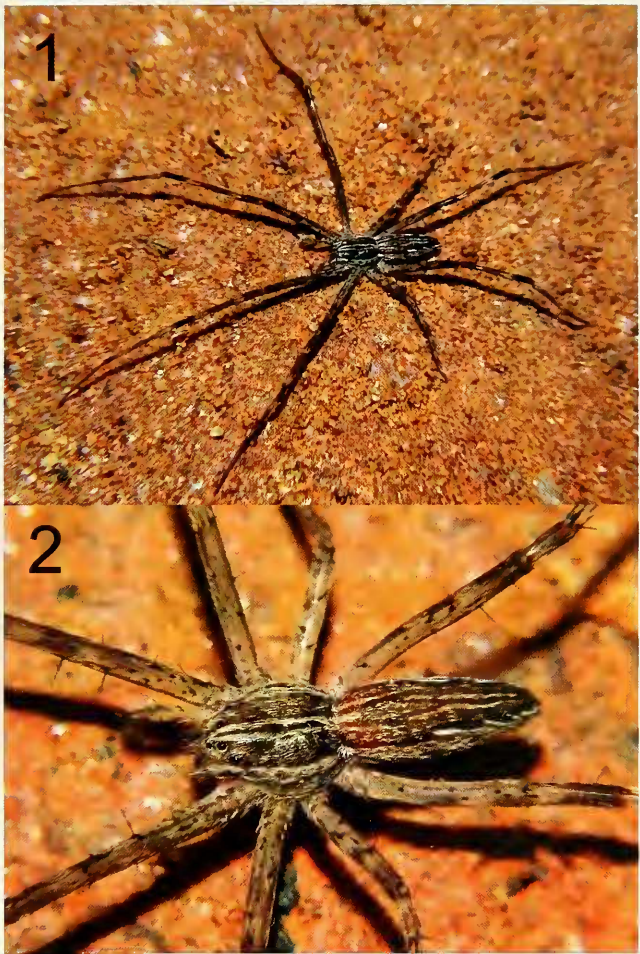
Leg measurements:

	I	II	III	IV
Femur	10.57	9.58	5.12	10.36
Patella + Tibia	10.05	10.56	5.17	9.89
Metatarsus	9.12	8.24	4.34	9.03
Tarsus	5.89	6.63	2.05	5.62
Total length	35.63	35.01	16.68	34.90

Opisthosoma oblong (Fig. 4); dorsum yellow, provided with dark brown median band, with black pigments and white spots laterally; cardiac area brown, with dark brown margins and a pair of black spots.

Male palp (Figs 5-7): Palpal tibia distinctly curved. Retrolateral tibial apophysis (RTA) broad at base, with sharply pointed apex, directed ventrally. Cymbium (Cy) elongate distally, approximately twice as long as tegulum (T). Tegulum more or less spherical, with superficial furrow on prolateral side. Distal tegular apophysis (DTA) membranous, petal-shaped. Median apophysis (MA) strongly sclerotized, sickle-shaped, without mesal projection. Conductor (C) membranous, forming a concave socket apically. Embolus (E) dark brown, needle-shaped, originating antero-prolaterally, accommodated by basal projection of embolus (BE).

Female (Siritharn Waterfall). Total length 12.77. Carapace 4.26 long, 3.74 wide. Opisthosoma 8.51 long, 3.63 wide.



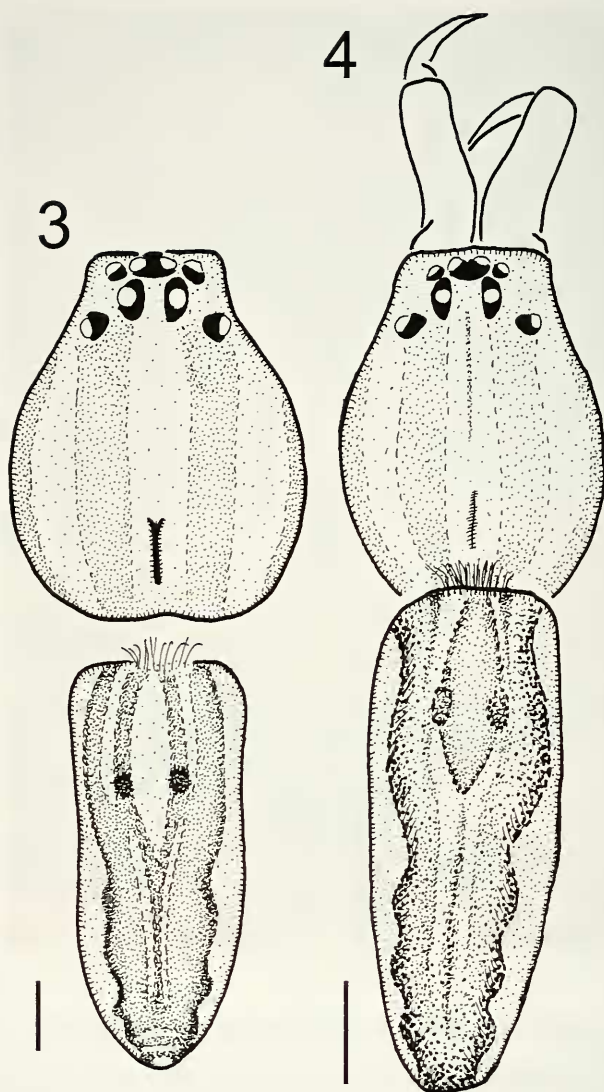
FIGS 1-2

Hygropoda argentata, adult female in typical resting posture.

Pattern and colouration as in males but larger in size (Figs 1, 2). Eye sizes and interdistances: AME 0.19, ALE 0.17, PME 0.22, PLE 0.24; AME-AME 0.14, AME-ALE 0.06, PME-PME 0.31, PME-PLE 0.45; MOQ 0.63 long, front width 0.58, back width 0.82.

Leg measurements:

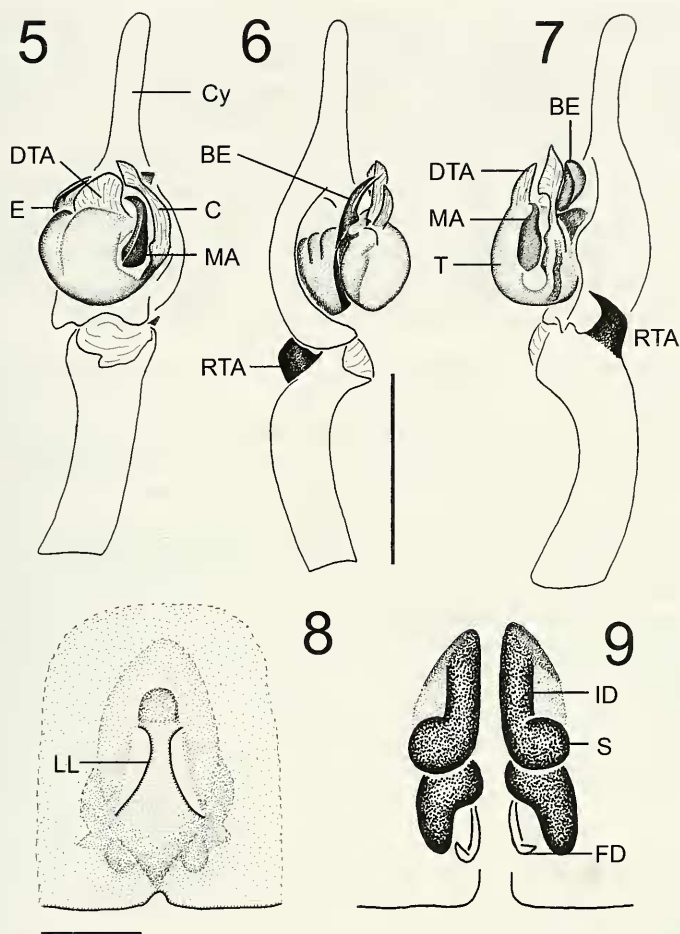
	I	II	III	IV
Femur	10.32	9.22	4.95	10.05
Patella + Tibia	9.87	10.40	4.99	9.51
Metatarsus	8.84	8.01	4.03	8.76
Tarsus	5.56	6.49	1.72	5.39
Total length	34.59	34.02	15.69	33.71



FIGS 3-4

(3) *Hygropoda yunnan* and (4) *H. argentata*, habitus of male, dorsal view. Scale line = 1.0 mm.

Epigyne and vulva (Figs 8, 9): Epigyne deeply excavated; with a bell-shaped epigynal hood located anteriorly; lateral lobes (LL) poorly developed, broadest posteriorly; median field of epigyne represented by a space between LL; insemination ducts (ID) relatively short, leading to modified spermathecae (S) that are divided into two parts: Rounded anterior spermathecal heads, and tubular posterior spermathecal bases, the latter slightly excavated on the inner side. Fertilization ducts (FD) originating posteriorly.



FIGS 5-9

Hygropoda argentata. (5) Left palp of male, ventral view. (6) Ditto, prolateral view. (7) Ditto, retrolateral view. (8) Epigyne, ventral view. (9) Vulva, dorsal view. Scale lines = 1.0 mm (5-7); 0.25 mm (8-9).

REMARKS: There is considerable variation in the shape of the genitalia. The female holotype possesses tubular spermathecal heads (see Zhang *et al.*, 2004: 380, fig. 73), which are not as round as in the female described here. The median field of the epigyne in the female examined (Fig. 8) slightly differs from that of the holotype; there it is represented by a rhomboidal groove (Zhang *et al.*, 2004: 380, fig. 72).

NATURAL HISTORY: *Hygropoda argentata* inhabits dry deciduous dipterocarp forest and mixed evergreen-deciduous forest dominated by pine trees between 510-1010 m elevation in the Doi Inthanon National Park.

DISTRIBUTION: Thailand (Chiang Mai Province, new record) and China.

***Hygropoda campanulata* Zhang, Zhu & Song, 2004**

Figs 10, 11

Hygropoda campanulata Zhang, Zhu & Song, 2004: 382, figs 74-76 (description of ♀).

MATERIAL EXAMINED: 1 ♀, western Thailand, Khanchanaburi Province, Thong Pha Phum District, Huay Kha-Khaeng Wildlife Sanctuary, Ban [Thai: Village] Patsadu Klang, 300 m, dry dipterocarp forest, 19.x.2002, leg. T. Promi [MHNG-HC1].

EXTENDED DIAGNOSIS: Females of *Hygropoda campanulata* resemble those of *H. argentata* in having a deeply excavated epigyne with its median field narrowed, longer than wide. The former species can be easily recognized by the presence of large anterior lateral lobes on the epigyne (Fig. 10) and by long parallel insemination ducts descending to bi-lobed, posteriorly situated spermathecae (Fig. 11).

DESCRIPTION: Female (MHNG-HC1). Total length 10.32. Carapace 3.51 long, 2.76 wide. Opisthosoma 6.81 long, 2.33 wide.

Carapace longer than wide; cephalic part higher than thoracic part, highest just behind ocular area. Fovea a deep longitudinal furrow located posteriorly. Carapace dark yellow, with a pair of dark brown longitudinal bands running from behind PER to posterior margin; dusky stripes on both lateral margins. Eye sizes and interdistances: AME 0.24, ALE 0.20, PME 0.23, PLE 0.26; AME-AME 0.18, AME-ALE 0.08, PME-PME 0.35, PME-PLE 0.46; MOQ 0.70 long, front width 0.62, back width 0.85. Chelicerae brown, fangs reddish brown; three small promarginal and three larger retromarginal teeth on cheliceral fang grooves. Sternum yellow.

Leg measurements:

	I	II	III	IV
Femur	9.86	8.30	5.41	9.10
Patella + Tibia	11.94	9.21	5.33	8.62
Metatarsus	9.62	8.98	4.35	7.93
Tarsus	10.13	6.46	2.38	5.54
Total length	41.55	32.95	17.47	31.19

Opisthosoma oblong; dorsum with distinctive pattern, provided with dark brown median band, with black pigments and white silvery spots laterally; cardiac area brown, with dark brown margins, background yellowish brown.

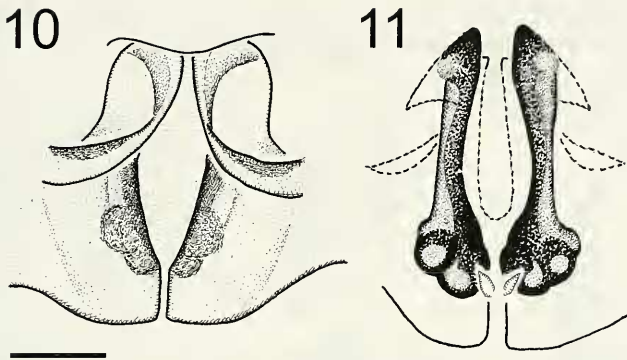
Epigyne and vulva (Figs 10, 11): Epigyne with lateral lobes occupying anterior half of epigyne, diverging from each other posteriorly; median field of epigyne longer than wide; insemination ducts long, leading to bi-lobed, heavily sclerotized spermathecae situated posteriorly.

Male unknown.

REMARKS: In the specimen examined the lateral lobes of the epigyne are distinctly larger than in the female holotype (see Zhang *et al.*, 2004: 380, fig. 75) and its insemination ducts are clearly divided into lightly sclerotized and strongly sclerotized parts, whereas in the female holotype they are not discernible.

NATURAL HISTORY: The specimen examined was collected in a lowland dry dipterocarp forest.

DISTRIBUTION: Thailand (Khanchanaburi Province, new record) and China.



Figs 10-11

Hygropoda campanulata. (10) Epigyne, ventral view. (11) Vulva, dorsal view. Scale line = 0.25 mm.

***Hygropoda yunnan* Zhang, Zhu & Song, 2004**

Figs 3, 12-16

Hygropoda yunnan Zhang, Zhu & Song, 2004: 385, figs 92-96 (description of ♀).

MATERIAL EXAMINED: Northern Thailand, Chiang Mai Province and District, Doi Suthep-Pui National Park, Pha Ngoeb, 400-500 m, 1 ♂, 3 ♀, 2 juv. [MHNG-HY1-6], 24.ix.2002, leg. P. Thamsenanupap. – 2 ♂ [TNHM], 8.x.2002, leg. P. Thamsenanupap. – Doi Suthep-Pui National Park, near Monthatharn Waterfall, 650-800 m: 2 ♀, 5 juv. [TNHM], 9.viii.2002, leg. P. Thamsenanupap. – 2 ♀ [MHNG], 8.x.2002, leg. P. Thamsenanupap. – Chiang Mai Province, Chomthong District, Doi Inthanon National Park, Huay Sai Lueang Waterfall, 1080 m, 1 ♀ [TNHM-HY], 6.x.-15.xi.2002, Malaise trap, leg. P. Thamsenanupap. – Mae Hong Son Province, Namtok Mae Surin National Park, Huay [Thai: Stream] Mae Surin, 1 ♀ [TNHM], 15.x.2002, leg. P. Thamsenanupap.

EXTENDED DIAGNOSIS: Males of *Hygropoda yunnan* can be recognized by the bifurcated retrolateral tibial apophysis (Fig. 13) and by the peculiar median apophysis provided with a thin mesal spike (Figs 12, 13) (represented by a small tubercle in *H. higenaga* but absent in *H. argentata*). Females of this species can be identified by the epigyne with a triangular anteriomedian tubercle flanked by large anterolateral lobes (Fig. 15). The median field of the epigyne is triangular and provided with longitudinal ridges, the insemination ducts are long and curved, leading to rounded spermathecae situated posteriorly (Fig. 16).

DESCRIPTION: Male (MHNG-HY1). Total length 6.94 Carapace 3.33 long, 2.61 wide. Opisthosoma 3.61 long, 1.52 wide.

Carapace longer than wide (Fig. 3), slightly higher in cephalic part, gradually lowering towards thoracic part. Fovea a deep longitudinal furrow located posteriorly. Carapace pale yellow, with two dark parallel bands running from behind PME and PLE to posterior margin; a thin mesal line running between PME and fovea; dusky stripes on both lateral margins. Eight eyes arranged into two rows: AER slightly recurved; PER distinctly recurved, much wider than AER; MOQ longer than wide, wider behind than in front. Eye sizes and interdistances: AME 0.28, ALE 0.18, PME 0.30, PLE 0.30; AME-AME 0.15, AME-ALE 0.10, PME-PME 0.36, PME-PLE 0.46; MOQ 0.75 long,

front width 0.59, back width 0.84. Chelicerae orange, fangs brown; three small promarginal and three larger retromarginal teeth on cheliceral fang grooves. Sternum yellow.

Leg measurements:

	I	II	III	IV
Femur	8.91	7.40	4.62	8.21
Patella + Tibia	11.18	8.32	4.53	7.78
Metatarsus	8.73	6.17	3.51	7.16
Tarsus	9.16	5.69	1.52	4.75
Total length	37.98	27.58	14.18	27.90

Opisthosoma (Fig. 3) elongate, tapering posteriorly; dorsum yellow, with a broad longitudinal dark brown band, anteriorly marked with pale cardiac area, laterally striated with distinct black pigments on margins, followed by a series of transverse pale patches.

Male palp (Figs 12-14): Palpal tibia slightly curved. Retrolateral tibial apophysis with a small triangular proximal branch and a larger distal branch reaching about 1/4 of cymbial length. Cymbium with digitiform apex, relatively short, approximately of the same length as the tegulum. Tegulum orange-brown, with a distinct anterior, slightly sclerotized excavation at the base of the triangular distal regular apophysis. Median apophysis with a thin and long mesal spike pointing upwards. Conductor membranous. Embolus black, needle-shaped, originating baso-prolaterally, accommodated by a strongly sclerotized basal projection of the embolus.

Female (TNHM-HY). Total length 10.77. Carapace 4.58 long, 3.54 wide. Opisthosoma 6.19 long, 2.28 wide.

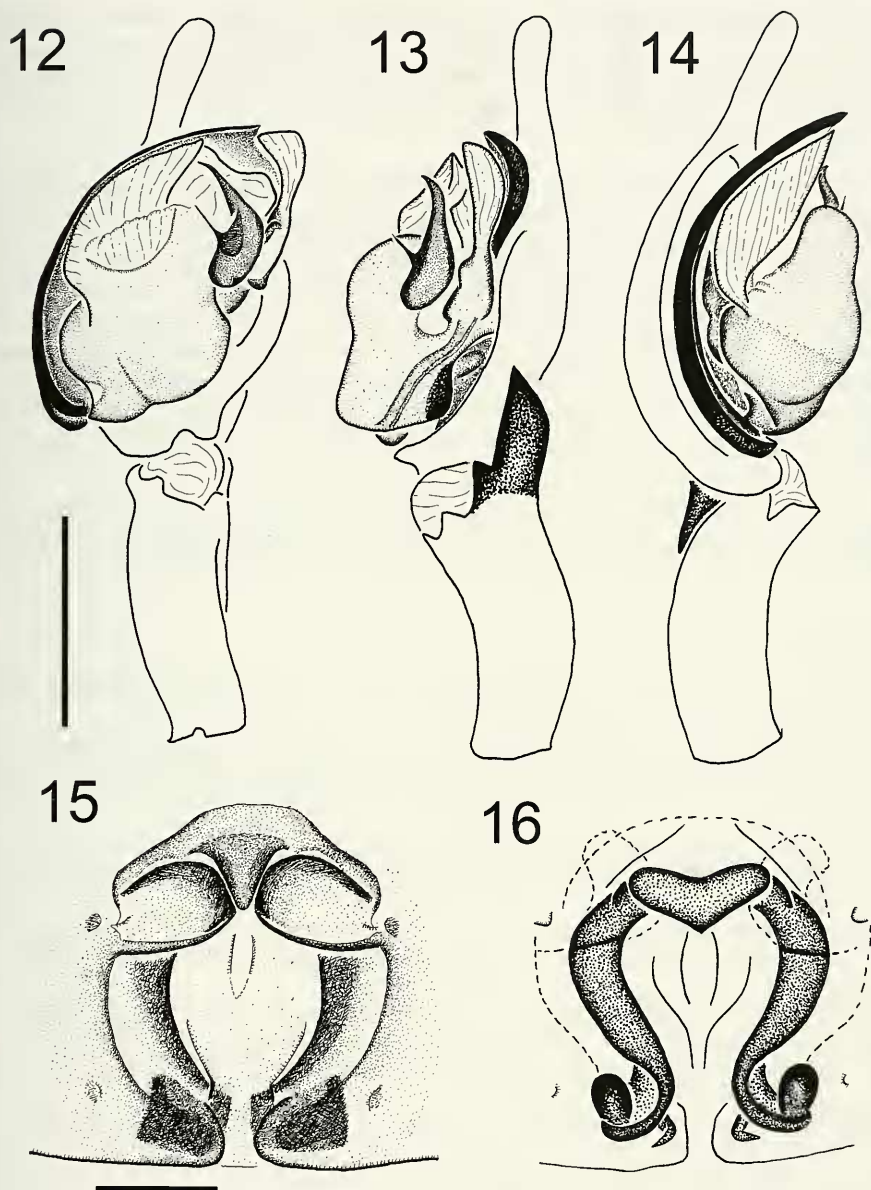
Colouration and pattern as in males but larger in size. Eye sizes and interdistances: AME 0.24, ALE 0.18, PME 0.26, PLE 0.25; AME-AME 0.12, AME-ALE 0.08, PME-PME 0.34, PME-PL 0.45; MOQ 0.70 long, front width 0.55, back width 0.81.

Leg measurements:

	I	II	III	IV
Femur	8.62	7.21	4.41	8.10
Patella + Tibia	10.95	8.13	4.40	7.58
Metatarsus	8.56	5.97	3.30	6.95
Tarsus	8.98	5.43	1.42	4.61
Total length	37.11	26.74	13.53	27.24

Epigyne and vulva (Figs 15, 16): Epigyne with a strongly sclerotized, anteriorly located triangular tubercle surrounded by a pair of large anteriorly situated lateral lobes; large postero-lateral lobes very distinct; median field of epigyne with a longitudinal ridge, anteriorly broad, gradually narrowing posteriorly. Vulva with a sclerotized, more or less triangular distal plate; insemination ducts strongly sclerotized, extending to posterior spermathecae; spermathecal heads rounded.

REMARKS: The holotype possesses a lateral tubercle on the spermathecal head (see also Zhang *et al.*, 2004: 384, fig. 96) which is indistinct in the specimens examined from northern Thailand.



FIGS 12-16

Hygropoda yunnan. (12) Left palp of male, ventral view. (13) Ditto, retrolateral view. (14) Ditto, prolateral view. (15) Epigyne, ventral view. (16) Vulva, dorsal view. Scale lines = 1.0 mm (12-14); 0.25 mm (15, 16).

NATURAL HISTORY: Specimens of *H. yunnan* were obtained by sweeping vegetation along streams running through dry deciduous dipterocarp forest, mixed deciduous forest and gallery evergreen forest between 400-1080 m elevation.

DISTRIBUTION: Thailand (Chiang Mai and Mae Hong Son Provinces, new record) and China. Judging from the relatively wide distribution range of *H. yunnan*, this species presumably occurs all over the northern part of the kingdom.

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